

A I R F O R C E P A M P H L E T

Fire Protection and Aircraft Rescue

FIRE FIGHTING GUIDANCE NUCLEAR WEAPONS

15 OCTOBER 1958

D E P A R T M E N T O F T H E A I R F O R C E

AIR FORCE PAMPHLET
NO. 92-1-1

DEPARTMENT OF THE AIR FORCE
WASHINGTON, 15 October 1958

Foreword

This pamphlet has been developed to give fire fighters basic information on firefighting and communications procedures, evacuation criteria, and the probable effects of nuclear weapons subjected to an impact accident or fire. It tells how to fight fires in aircraft and other vehicles that transport nuclear weapons, as well as in related support facilities. The recognition of associated hazards will also afford greater safety and effectiveness in firefighting and rescue operations.

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FIRE FIGHTING GUIDANCE—NUCLEAR WEAPONS

1. Background

a. The possibility of a *nuclear* contribution (atomic explosion) from the detonation of a nuclear weapon or warhead involved in a fire, inadvertent release, or impact accident, is so small as to be practically non-existent. Safety features and devices have been carefully designed and incorporated in nuclear weapons and warheads to make this assurance possible. These safety features, however, are not present in high explosive (HE) detonation.

b. The presence of nuclear weapons in aircraft and other vehicles or support facilities creates no greater hazard, in general, than does the presence of high explosives. In fact, the amount of high explosive is considerably less than that found in a high explosive (HE) bomb of the same size. However, nuclear weapons differ from high explosive (HE) bombs in that minor chemical and/or radiological hazards may exist during and after an accident or fire.

c. Basically, the same techniques that are used for fighting aircraft fires, particularly those in which conventional high explosive bombs are involved, are used where nuclear weapons are involved; special extinguishing agents are not required to control and extinguish such fires. Even though nuclear weapons are carried by various types of ground vehicles and USAF aircraft, the fire-fighting and fire protection requirements will be the same. The brief length of time available to control or extinguish the fire, before an explosion can be expected, is the only special factor to consider (see paragraph 2b). Therefore, an understanding and application of firefighting and rescue procedures is vital to the training and team work that are an indispensable functional requirement in firefighting.

d. *Types of Vehicles Used To Transport Nuclear Weapons:*

(1) *Airplanes:*

(a) *Combat Planes:* USAF operational interceptor, fighter-bomber and bomber

aircraft are equipped to carry, deliver or transport nuclear weapons and/or their components.

(b) *Cargo Planes:* Large cargo planes are used to transport nuclear weapons and parts of nuclear weapons. Weapons and components aboard cargo planes are usually contained in special weapon containers, securely tied to the aircraft structure by specially designed tie-downs and mountings.

(2) *Trucks:* Nuclear weapons and components are transported by truck. These weapons and components will be contained in special containers securely tied down to the bed of the truck.

(3) *Trains:* Nuclear weapons and components are transported by train within the continental limits of the United States. These weapons and components will be contained in special railroad cars and specially designed containers provided for the purpose. Specialty security guards accompany train and truck shipments.

(4) *Naval Vessels:* Nuclear weapons and components are transported by naval vessels. These weapons and components will be contained in special compartments.

2. Nuclear Weapon Characteristics

a. *Description.* In general, nuclear weapons resemble conventional bombs in that they are inclosed in a shell or casing that is generally cylindrical in shape, with tail fins. The weapon or warhead casings are of various thickness and may or may not break up upon impact. Most weapons contain a conventional type of high explosive which may detonate upon moderate to severe impact or when subject to fire. The quantity of high explosive involved in a detonation, if one occurs, may vary from a small amount to several thousand pounds and constitutes the major hazard in such an accident. If the casing breaks upon impact, the exposed and unconfined pieces of high explosive can ignite and burn. Some minor radiological haz-

ards may exist regardless of the type of weapon, if the weapon burns or if detonation of the high explosive occurs. This hazard is discussed fully in paragraph 4.

b. *Time Factors.* The length of time available to fight a fire involving nuclear weapons safely, depends largely upon the physical characteristics of the weapon or warhead case, the intensity of the fire and the proximity of the fire. Since weapon and warhead cases vary in thickness, fire fighting "time factors" range from three minutes to an indefinite period if the fire-impact incident does not detonate the high explosive immediately. The time element for each type of nuclear weapon and/or component is an *important factor in fighting these fires*. As soon as fire envelops the weapon area in a ground vehicle, aircraft fuselage compartment, bomb bay, or wing section where external weapons are carried, these "time factors" become effective. For weapons or warheads within a fire-impact incident area, and subject to extreme heat but not enveloped in flames, a time factor of fifteen minutes will apply; *if the fire fighting time factor is unknown to the fire fighters, the minimum time factor should be observed*. When evacuation of fire department personnel and equipment during firefighting operations is required, immediate withdrawal to predetermined distances should be made upon order of fire department supervisor-in-charge.

c. *High Explosive Blast and Fragmentation.* The radius of a weapon high explosive blast varies, depending on the amount of high explosive actually detonated; high explosive blast fragmentation distances for these weapons range from a minimum radius of 400 feet to a maximum of 1000 feet. Personnel within these areas may be seriously injured from blast or fragmentation upon detonation of the high explosive. These areas and distances must be considered in evacuating firefighting personnel and during the initial fire department approach to an incident where weapons have been enveloped in flame for a period approximating or exceeding the weapon time factor limitation. All except firefighting personnel should im-

mediately evacuate to a minimum distance of 1500 feet for protection from blast and fragmentation.

d. *Precautionary Measures*

(1) *Under no circumstances* should any high explosive material from ruptured weapons that have been exposed to fire (or any components that have been scattered), *be handled, stepped on, driven over, or disturbed in any manner*. This material is extremely sensitive to minor detonations from shock or impact and may cause serious injury.

(2) Protective clothing and breathing apparatus must be worn during firefighting operations to provide the fire fighter maximum protection from any chemical or minor radiological hazards that may be present. Additional protection is afforded by fighting from an up-wind position.

(3) Monitoring the disaster area after a fire and/or explosion, as well as handling the weapon and/or components, is a responsibility of predesignated specialized recovery personnel. (Explosive Ordnance Disposal Personnel.) *This is not a fire department responsibility.*

(4) All exposed clothing, apparatus, and equipment used during a fire or impact incident where nuclear weapons or components have been involved should be monitored for possible radiological contamination by specialized recovery personnel equipped for this purpose. *This is not a fire department responsibility.*

3. Nuclear Weapon Components

a. *High Explosive Components—Time Factor Unlimited.* Cylindrical cans approximately 12 inches in diameter, and 18 inches long, sometimes accompany the weapons. Two of these cans are generally strapped together and are identified by the markings HIGH EXPLOSIVE, stenciled on top and sides. Each can contains about 25 lbs. of high explosive and may detonate upon severe impact without being subjected to fire. If these cans are subjected to fire, or if the explosives are melted and re-solidified, these

components become extremely sensitive to shock or impact, *with detonation probable*. These components should not be stepped on, driven over, or disturbed in any manner. They should be handled only by Explosive Ordnance Disposal Personnel.

b. *Other Components—Time Factor Unlimited*. Other high explosive components are sometimes carried in metal containers similar to a suitcase with a handle. The container measures approximately 36 x 14 x 5 inches and is marked EXPLOSIVES, KEEP DRY on both sides. If the container breaks open upon impact, scattering the contents, and there is no fire present in the vicinity, there is no immediate explosive hazard. However, these components are extremely sensitive to heat or shock and *should not be picked up, stepped on, driven over, or disturbed in any manner*. They should be handled only by Explosive Ordnance Disposal Personnel.

c. *Nuclear Components—Time Factor Unlimited*. Nuclear material may sometimes be stored or transported in aircraft and other vehicles in a tubular carrying container which is made of stainless steel, is cylindrical in shape, and is inclosed in a welded-pipe cubical frame approximately 3 feet on each side. These components present no explosive hazard when subjected to impact or fire. However, a minor radiological hazard may exist if the cylindrical (center) portion of the carrying case has been ruptured; the normal protective clothing and breathing apparatus provided fire fighters will eliminate or materially minimize this hazard, however. The nuclear material is of great value and *if possible*, should be protected from fire so that it may be salvaged. To prevent possible radiation, these containers should always be separated from each other by a distance of at least three feet. The tubular frame, if intact, will insure this.

d. *Inert Items—Time Factor Unlimited*. Material of this nature includes training weapons and warheads, and their components, identified by appropriate markings (i.e., training weapons). These items present no explosive hazard.

5. Associated Hazards

a. *Radiological*. In the event of a high explosive detonation or burning of a weapon, one has to concern himself only with Alpha emitting contamination. Other types of radiation, which are harmless, may be detected with the use of sensitive detection instruments. (The effect of this radiation may be likened to the effects of radiation emanating from a luminous dial wristwatch.) Since Alpha-emitting particles are so fine that they are carried as smoke or dust from the burning or high explosive detonation of a nuclear weapon, some Alpha emitting contamination may be expected in the immediate accident area and down-wind. Although this material may present a *minor radiation problem*, DANGER from these particles exists only when they are INHALED in significant amounts. Protection against highest expected Alpha levels from such burning or high explosive detonation incidents is afforded firefighting personnel by the prescribed protective clothing and breathing apparatus.

b. *Fire*. Hazards associated with the burning of nuclear weapons and components are generally the same as those presented by conventional high explosive. Confined high explosives involved in fire are likely to result in some order of detonation. Explosives contained in some weapons may melt and flow without burning, and then become solid again upon cooling; this type of explosive leaves a buff, yellow, or orange residue, sometimes turning rust red from the flame or extensive heat. This residue, together with the remaining unmelted high explosive and weapon components, may detonate upon shock or impact. It must be handled and removed only by personnel specifically trained in the disposal of ordnance material.

c. *Impact*. Weapons or warheads may break up and the high explosive detonate from impact. Detonation and break-up is contingent to a large degree upon the characteristics of the weapon or warhead case, the impact velocity, and the location of aircraft suspension devices (or in ground trans-

portation vehicles, the securing devices and their resistance to impact shock. If weapons or warheads have ruptured from an impact, so that the high explosive is exposed and involved in fire, there is very little danger of high explosive detonation while this material is burning. These high explosive pieces, burning or non-burning, vary in size from very small to those of considerable bulk.

d. *Sympathetic Detonation.* Detonation of a weapon or warhead, by fire or by impact, is also likely to induce detonation (non-nuclear) of any other weapon or warhead in the open within a 50 to 300-foot radius of the incident area.

e. *High Explosive Burning Characteristics.* Flame and smoke characteristics of burning high explosives vary, and provide no specific pattern upon which to determine when the high explosive is about to detonate. Burning high explosives produce flames of various colors; they may be bright red, yellow, greenish-white or combinations of no predominant color. Some give off a white smoke, while others burn with no trace of smoke.

6. Procedures

a. *General.* Under normal conditions, USAF Base Fire Departments are alerted when an aircraft is about to take off or land with high explosives (including nuclear weapons or components). In the event of an aircraft accident on or off a base or installation, the general procedure for fighting aircraft fires involving high explosive weapons, applies equally to fires involving aircraft carrying nuclear weapons. Rescue of personnel is primary and should proceed simultaneously with the fire control measures as determined by the situation. Firefighting efforts will normally be concentrated on controlling the fire and cooling the area surrounding the weapon and/or components, and preventing the further spread of the fire which would necessitate withdrawal from the area. When evacuation of firefighting personnel is imminent, withdrawal should be made to a distance of 1000 feet. At this

distance, personnel will not be injured by high explosive blast or shock, but some may become casualties as a result of the flying debris. Personnel should take advantage of any cover available, i.e., ditches, vehicles, structures, etc. All personnel other than firefighters and support personnel should immediately be evacuated to a minimum distance of 1,500 feet.

b. *Fire Extinguishment—Control.*

(1) The normal approach and positioning of apparatus and firefighters must afford maximum and effective application of extinguishing agents on the critical area, and permit rapid withdrawal of personnel and equipment from the area.

(2) Volume application of foam extinguishing agent or waterfog is the most effective method for maintaining fire control, for other than incipient fires (which can be controlled and extinguished with a relatively moderate quantity of CO₂ or similar quick smothering type agent). Volume application of CO₂ is equally effective used in conjunction with primary foam extinguishing agent, for controlling fires of this nature.

c. *USAF Communications Procedures.* When circumstances require an aircraft carrying explosive cargo to land at an airport other than a USAF base, the aircraft commander will utilize air-to-ground radio transmission to warn appropriate authorities of the *emergency conditions*. The air-to-ground radio communications procedure which has been established is illustrated in the following example of unclassified transmission:

EXPLOSIVE CARGO, WINGS OF AIRCRAFT. IF EXPLOSIVE BECOMES ENVELOPED IN FLAMES, DETONATION MAY BE EXPECTED IN FIVE MINUTES. APPLY EMERGENCY PROCEDURES ACCORDINGLY.

(1) **EXPLOSIVE CARGO:** These words notify the airport that the type of cargo aboard the aircraft is hazardous, and can be conventional high explosive bombs, nuclear weapons and/or their components, or any cargo likely to detonate when exposed to fire or impact.

(2) **WINGS OF AIRCRAFT.** In the

above example, WINGS OF AIRCRAFT, gives the location of the explosive cargo in or on the aircraft; this location varies according to the type of aircraft. Bomber aircraft normally carry explosive cargo in the bomb bay, which is located in the center or aft position of the fuselage, or in a "pod" located under the centerline of the aircraft. Transport aircraft carry explosive cargo within the fuselage, in any location from the pilot compartment aft to the tail section. Interceptor or fighter-bomber aircraft normally carry explosive cargo under the wing or under the fuselage center line; in some instances, however, it may be carried in a bomb bay within the fuselage, located near the wings.

(3) FIVE MINUTES. In the above example, FIVE MINUTES gives the time factor or number of minutes firefighting may continue safely after the explosive cargo has become enveloped in flames, and indicates the time required for firefighting personnel to withdraw to a safe distance. As already explained in paragraph 2(b), this time factor varies, depending upon the type of explosives in the cargo.

d. Loading and Unloading Procedures and Precautions.

(1) During aircraft loading and unloading of nuclear weapons and other explosive cargo, at least two portable wheel-type fire-extinguishing units should be available. Each unit shall have a fire-extinguishing capability equal to that of 50 pounds of carbon dioxide.

Positioning and operating these fire-extinguishing units is the responsibility of the aircraft commander and/or loading supervisor.

(2) When he is notified of loading operations, the base fire chief may, at his discretion, and within his capability, provide qualified firefighters to stand by with the portable fire-extinguishing units or whatever mobile fire equipment is considered advisable to augment and assist loading personnel in an emergency under the particular circumstances.

(3) Every effort will be made to insure satisfactory communications between the loading operation and the fire department communications center. This is normally done by using the aircraft radio in conjunction with control tower. Only qualified personnel will operate the aircraft radio when this means of communication is used.

7. Summary

The hazard in fighting a fire involving nuclear weapons and/or components is no greater in principle than that encountered in fighting a similar fire involving high explosive weapons. The safety of personnel and their effectiveness in firefighting operations depend upon strict adherence to the TIME FACTOR, the degree of team work, discipline, and instant compliance with supervisor's orders; they are the essential and positive factors which govern the success of the overall firefighting operation.

